

# PATENT SPECIFICATION

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## (54) NOSE CAP AND DIAPHRAGM ASSEMBLY FOR A MEDICAMENT INJECTOR

(71) We, AMERICAN HOSPITAL SUPPLY CORPORATION, a corporation organized under the laws of the State of Illinois, United States of America, of 1740 Ridge Avenue, Evanston, Illinois 60201, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:-

This invention relates to a nose cap and diaphragm assembly for attachment to the barrel of an injector for medicaments. The invention further relates to an injector incorporating the assembly.

The present invention provides a nose cap and diaphragm assembly for use in an injector including a cylindrical barrel closed at its rearward end by a slidable plunger and at its forward end by the nose cap and diaphragm assembly, said assembly comprising:

a nose cap, said nose cap having a body portion, said body portion having a central bore therethrough which aligns with the longitudinal axis of the barrel when the nose cap is assembled on the forward end of said barrel, the body portion having a forward and a rearward face, means extending forwardly from the body and in fluid communication with the aforesaid bore adapted to receive and mount an injection needle, means extending rearwardly from the body adapted to receive the forward end of the cylindrical barrel, a spike on the rearward side of the body axially aligned with the body bore and having its point directed rearwardly, means for mounting the spike in the aforesaid position, and a diaphragm fitted on the rearward side of the body portion so as, in use, to seal off the forward end of the cylindrical barrel from the aforesaid bore, said diaphragm comprising a cylindrical body having one open end, a flexible and pierceable member attached to and closing off the other end of this cylindrical body, the diaphragm being fitted into the nose cap on the rearward side so that the cylindrical body fits around the spike and the closed end is normally spaced rearwardly therefrom.

The present invention further provides an injector comprising a nose cap and diaphragm assembly according to the invention with the rearward face of the nose cap engaged with one end of a cylindrical barrel, the other end of the barrel containing a slideable plunger, and with the forward face of the nose cap engaged with an injection needle, whereby in use of the injector the pressure generated by operation of the plunger flexes the flexible member to engage and be pierced by the spike to establish fluid communication between the barrel and the injection needle via the bore in the nose cap.

The present invention is particularly suitable for application to a disposable medicament injector.

A preferred embodiment of this invention will now be described with reference to the accompanying drawings, in which:

Figure 1 is a longitudinal sectional view of the injector illustrating it in the loaded, ready for use condition;

Figure 2 is a longitudinal sectional view of the injector illustrating the unit after the plunger has moved forward to flex the diaphragm end wall inwardly for piercing by the spike to allow medicament to flow therethrough, and

Figure 3 is an end elevational view looking into the nose cap with the diaphragm removed to illustrate the means for supporting the spike.

Referring to the drawings, a disposable injector 10 comprises a cylindrical glass barrel 12 having a forward end 14 and a rearward end 16 and an inner surface 18 and an outer surface 20. A rubber plunger 22 is sealingly and slidably carried in the rearward portion of the barrel 12. The plunger 22 is provided with a plurality of circumferential ridges 24 which act as sealing means for the plunger upon engagement with the inner surface 18 of the barrel 12. The forward end of the plunger 22 is closed off by an end face 26 while the rear end has an axially disposed threaded opening 28 engaged with a threaded plunger rod 30.

A nose cap and diaphragm assembly is positioned in the forward end of the barrel 12 and comprises a nose cap 34 including a body

portion 36 having a central through bore 38 aligned with the longitudinal axis of the barrel 12. A cylindrical projection 40 extends forwardly from the body bore 38. The outer surface 44 of the projection 40 is tapered to conform to the conventional Luer taper. A cylinder 46 extends forwardly from the body 34 and spacedly surrounds the projection 40. The cylinder 46 is internally threaded to accommodate mating elements 48 on needle hub 50 mounting needle 52.

An outer sleeve 60 extends rearwardly from body portion 36 and has its longitudinal axis aligned with that of bore 38. Outer sleeve 60 has an outer surface 64 and an inner surface 62. An inner sleeve 66 having a diameter less than that of outer sleeve 60 extends rearwardly from body 36 and has its longitudinal axis in alignment with that of bore 38.

The inner sleeve 66 has an outer surface 68 and an inner surface 70. An annular space is formed between the outer surface 68 of the inner sleeve 66 and the inner surface 62 of the outer sleeve 60, the annular space receiving the forward end portion of barrel 12.

The nose cap 34 is formed as a unitary structure comprising the body portion 36, projection 40, cylinder 46 and outer and inner sleeves 60 and 66.

A spike 80 is positioned rearwardly of body 36 and coaxially with the longitudinal axis of outer sleeve 60. The spike 80 is conical in shape with its point 82 directed rearwardly and terminating short of the rearward edge of the outer sleeve 60. The spike is mounted within the sleeve 60 by means of three segmental supports 90 which extend rearwardly from the body 36. More specifically, each segmental support 90 comprises a longitudinal body 92 having inner and outer body surfaces 94 and 96 corresponding in curvature to that of the inner surface 70 of inner sleeve 66. The longitudinal bodies 92 are sized such that when the three bodies 45 are equidistantly positioned around the axis of the sleeve 60 a small passage 98 is formed to provide fluid communication between the area surrounding the spike 80 and the body bore 38. In such arrangement there is a space 50 100 between each adjacent body 92 to complete the aforesaid fluid communication. The outer surfaces 96 of the longitudinal bodies 92 and adjacent inner surface 70 of the inner sleeve 66 form an annular space 55 104 adapted to receive a portion of a diaphragm 110 to be described next.

Diaphragm 110 comprises a cylindrical base 112 having an upper end 114 and lower end 116. A flange 118 extends radially outward from the upper end 114 of the base 112 with a cylindrical wall 120 extending upwardly from the periphery of the flange 118. The upper end of the wall 120 is closed off by a flexible wall 122 having a reduced thickness relative to the remainder of the diaphragm 60 110 to aid in flexibility and pierceability. The diaphragm base 112 fits into annular space 104 formed by the inner surface 70 of inner sleeve 66 and the segmented surface formed by the outer surfaces 96 of the support bodies 92. It should be noted that end faces 97 of the supports 90 slope downwardly and outwardly to aid in the insertion of the diaphragm body into space 104.

A finger grip 130 is mounted on the rear end of the barrel 12 and includes a grip body 132 having an outer sleeve 134 and an inner sleeve 136 extending outwardly therefrom in spaced manner to form an annular space into which the rear end of the barrel 12 fits.

Finger grips 140 extend radially outward from the body 132.

In normal storage condition, the unit is stored without the plunger rod 30 and the needle 52. When readying for use, the plunger rod 30 is affixed to the plunger 22 and the needle 52 is assembled to the nose cap 34. After the needle 52 is inserted into the injection site, forward movement of the plunger 22 causes diaphragm wall 122 to contact the point 82 of the spike 80 and to be pierced thereby so as to provide fluid communication between the medicament chamber A and the needle 52. Central passage 42 of the projection 40 may be provided with a sintered metal filter 150 if desired.

**WHAT WE CLAIM IS:**

1. A nose cap and diaphragm assembly for use in an injector including a cylindrical barrel closed at its rearward end by a slidible plunger and at its forward end by the nose cap and diaphragm assembly, said assembly comprising:  
a nose cap, said nose cap having a body portion, said body portion having a central bore therethrough which aligns with the longitudinal axis of the barrel when the nose cap is assembled on the forward end of said barrel, the body portion having a forward and a rearward face, means extending forwardly from the body and in fluid communication with the aforesaid bore adapted to receive and mount an injection needle, means extending rearwardly from the body adapted to receive the forward end of the cylindrical barrel, a spike on the rearward side of the body axially aligned with the body bore and having its point directed rearwardly, means for mounting the spike in the aforesaid position, and  
a diaphragm fitted on the rearward side of the body portion so as, in use, to seal off the forward end of the cylindrical barrel from the aforesaid bore, said diaphragm comprising a cylindrical body having one open end, a flexible and pierceable member attached to and closing off the other end of this cylindrical body; the diaphragm being fitted into the nose cap on the rearward side so that the cylindrical body

fits around the spike and the closed end is normally spaced rearwardly therefrom.

2. A nose cap and diaphragm assembly according to claim 1, wherein the forward face of the nose cap has two substantially cylindrical projections defining an annular space to receive a hub portion of an injection needle and the rearward face of the nose cap has two substantially cylindrical 10 projections defining an annular space to receive an end of a cylindrical barrel.

3. A nose cap and diaphragm assembly according to claim 1 or 2, wherein the diaphragm comprises a cylindrical base mounted 15 on the rearward face of the nose cap, a circumferential flange extending radially outwards from the open end of the base, a cylindrical sleeve extending axially from the periphery of the flange and rearwardly from 20 the nose cap, and a flexible and pierceable wall closing the open end of the cylindrical sleeve.

4. A nose cap and diaphragm assembly according to claim 3, wherein the pierceable 25 wall has a thickness less than that of the cylindrical base and cylindrical sleeve.

5. A nose cap and diaphragm assembly according to any one of claims 1 to 4, wherein the spike is cone-shaped.

30 6. A nose cap and diaphragm assembly according to any one of claims 1 to 5, wherein

the nose cap is a unitary structure.

7. A nose cap and diaphragm assembly according to claim 1, substantially as described herein with reference to the accompanying drawings.

8. An injector comprising a nose cap and diaphragm assembly according to any one of claims 1 to 7, with the rearward face of the nose cap engaged with one end of a cylindrical barrel, the other end of the barrel containing a slidable plunger, and with the forward face of the nose cap engaged with an injection needle, whereby in use of the injector the pressure generated by operation of the plunger flexes the flexible member to engage and be pierced by the spike to establish fluid communication between the barrel and the injection needle via the bore in the nose cap.

9. An injector according to claim 8 substantially as described herein with reference to the accompanying drawings.

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COMPLETE SPECIFICATION

1 SHEET

This drawing is a reproduction of  
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